ABSTRACT

Enhanced Cable Modem Termination System (CMTS) functionality, including programmable digital domain modulators and demodulators for dynamic channel assignment, is incorporated into Fiber Nodes (FNs) or mini Fiber Nodes (mFNs), yielding enhanced Fiber Nodes (eFNs). These eFns distribute CMTS functionality deep into Hybrid-Fiber-Coax Networks (HFCN) rather than centralizing the CMTS functions within a single location. Moving the cable modem terminations closer to the subscribers shortens the analog RF paths required to support cable modems. Communication of both subscriber data and CMTS control data is performed over Ethernet-compatible packet networks between the field-based CMTSs and an upstream facility (e.g., the Head End), which includes an Internet gateway. Packet data for multiple subscriber cable modems is easily compressed and merged over common network paths, reducing cabling plant complexity and increasing bandwidth utilization. This approach dramatically reduces the infrastructure cost per cable modem. Distributing CMTS functionality among multiple eFNs also reduces demands on already stretched resources at the Head End for space, power, and HVAC. For HFCN channels containing signals with modulation or encoding schemes that are unknown or best processed upstream, the invention also provides for tunneling their spectrum over the same packet network as used for the cable modem data. The channels to be tunneled are isolated using digital receivers, translated to baseband, their data framed, merged with cable modem subscriber data, and transmitted over the packet network. Upstream, the framed channel data is parsed and the original channel spectrum reconstructed to permit information recovery.